June 10, 1941. L. HAMMOND 2,245,338

MUSICAL INSTRUMENT

Filed July 30, 1940 2 Sheets-Sheet 1

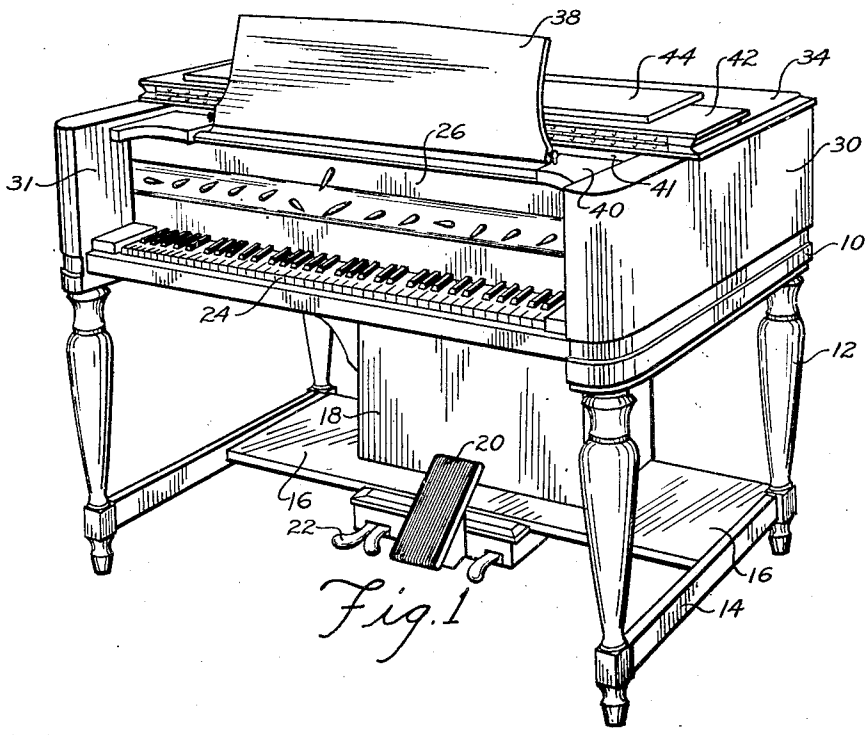


Fig. 1

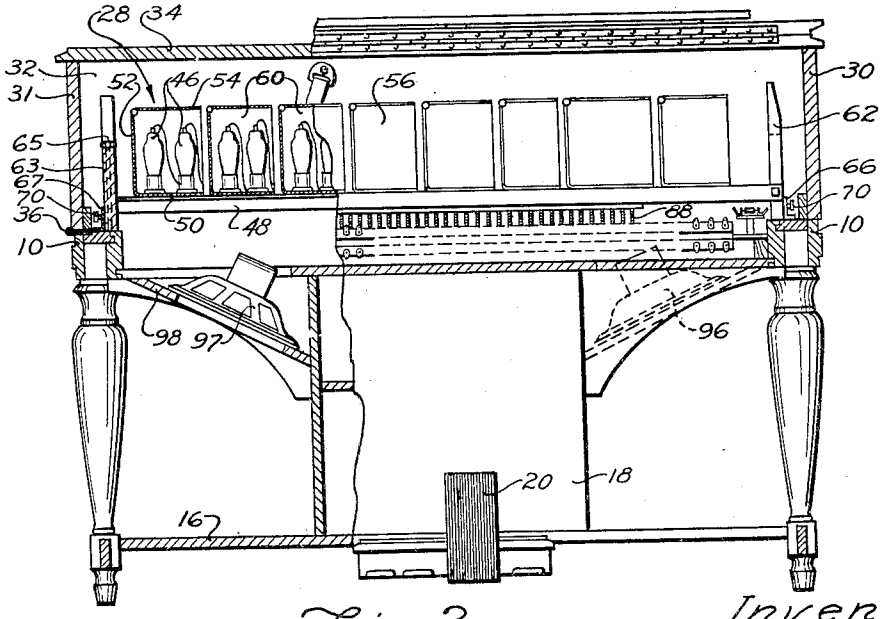


Fig. 2

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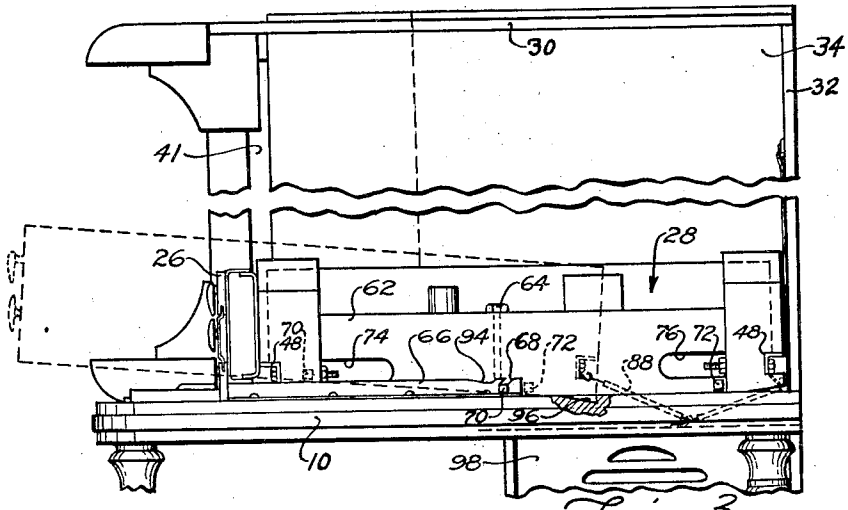


Fig. 3

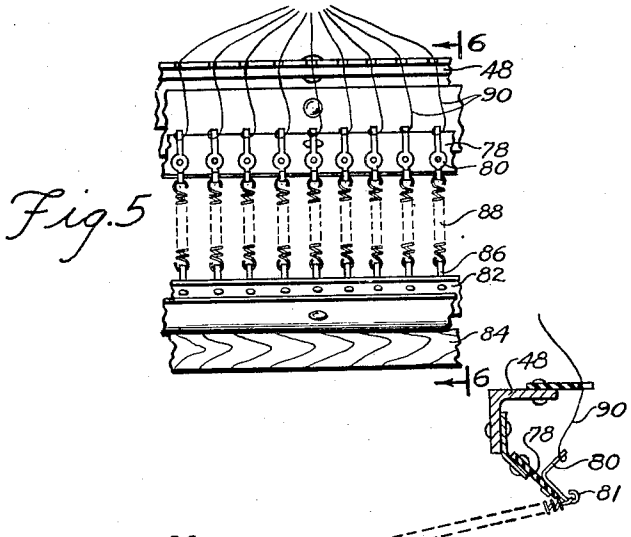


Fig. 5

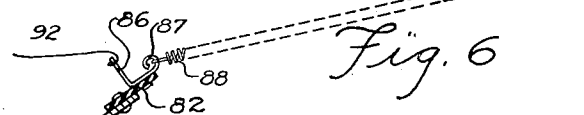


Fig. 6

Fig. 4

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Patented June 10, 1941

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UNITED STATES PATENT OFFICE

2,245,338

MUSICAL INSTRUMENT

Laurens Hammond, Chicago, Ill.

Application July 30, 1940, Serial No. 348,414

9 Claims. (Cl. 84—1.01)

My invention relates generally to musical instruments, and more particularly to improvements in the construction of cases for electrical musical instruments.

A further object is to provide an improved case for an electrical musical instrument in which the electrical parts are readily accessible for inspection and servicing.

A further object is to provide an improved electrical musical instrument case construction in which one assembly of electrical elements is movable with respect to another assembly of electrical elements, and a plurality of electrical connections between the two assemblies is provided by a series of coil springs.

A further object is to provide an improved case for electrical musical instruments which is of improved construction having good acoustical characteristics, in which the component parts are readily accessible, and which may be economically manufactured.

Other objects will appear from the following description, reference being had to the accompanying drawings in which:

Figure 1 is a perspective view of the instrument;

Figure 2 is a fragmentary sectional view of the instrument taken on vertical planes, one passing through the speaker, and the other behind the control panel;

Figure 3 is a fragmentary right-side elevational view with the case cover as shown in raised position;

Figure 4 is a fragmentary side elevational view showing the generator assembly in vertical position; and,

Figures 5 and 6 are fragmentary details showing the electrical connections between the generator assembly and the keyboard assembly.

As best shown in Figs. 1 and 2, the instrument comprises a case consisting of a main supporting frame 10 carried by four legs 12, the bottoms of the legs at each side being joined by rung bars 14. A sound reflecting board 16 is carried by the rungs 14, the support 16 also being connected to a power supply enclosure 18 and serving as a support for an expression pedal 20 and various sustaining pedals 22.

A key manual assembly 24 is mounted upon the main supporting frame 10, while a control panel 26 is carried by a generator assembly designated generally by the reference character 28. A case cover comprises a pair of side walls 30, 31, a rear wall 32, and the top 34 which are rigidly secured together and are hinged to the main supporting frame 10 by a hinge 36.

A music rack 38 is hinged to a front cross member 40 which is secured to the side members 30 and 31, there being an opening 41 between the rear edge of the music rack supporting member 40, and the forward edge of the top 34. A top extension plank 42 is hinged to the forward edge of the top 34, and has hinged thereto a front cover board 44. These parts 38, 42 and 44 are so conformed that when the music rack 38 is swung forwardly to a horizontal position, the boards 42 and 44 may likewise be swung forwardly so that the board 42 will form an extension of the top 34 and cover the music rack, while the front cover 44 will drop into a vertical position in front of the manual 24, thus completely enclosing the space in which the manual 24 and control panel 26 are located.

The instrument disclosed comprises a plurality of vacuum tubes 46 constituting generators and control tubes, as disclosed in my prior Patent No. 2,126,682, these tubes 46 and other electrical elements of the circuit being designated generally the generator assembly 28. As shown in Fig. 2, the tubes are supported upon a frame consisting of angle irons 48 and a sheet 50, the tubes being arranged in channels extending from the front to the rear of the instrument, the channels being formed by shielding enclosures consisting of vertical sheets 52 to the upper edges of which are hinged horizontal cover sheets 54. The forward ends of the channels are closed by sheets 56, while the rearward ends thereof are closed by sheets 58. Suitable partitions 60 are provided to form electrostatic shields between adjacent groups of tubes in each of the channels.

The angle irons 48 have their ends secured to side planks 62 and 63 which are secured to the main supporting frame 10 by studs 64, 65, the lower ends of which are threaded in suitable sockets formed in the sides of the main frame 10. A pair of similar angle irons 66, 67 have their horizontal legs rigidly secured to the main frame 10, and have notches 68 (Fig. 3) formed adjacent their rearward ends to receive the projecting ends of lag screws 70 when the generator assembly is in its normal position, the lag screws being threaded into the side planks 62 and 63. Each of the side planks 62, 63 has a lag screw 72 threaded therein adjacent the rear end thereof. Handhole openings 74, 76 are provided in each of the side planks 62, 63.

Attached to the rearmost angle 48 of the generator assembly is a strip 78 of insulating mate-

rial to which a plurality of soldering lugs **80** are attached. A similar strip **82** of insulating material is secured to a transverse board **84** which is rigid with the main supporting frame **10**, this strip **82** having a plurality of soldering lugs **86** riveted thereto. The lugs **86** are each provided with an eye portion **87** to receive the end of a coil spring **88**, the other end of each of the coil springs being anchored in a hooked portion **81** of one of the lugs **80**. Conductors **90** are soldered respectively to the lugs **80**, and have their other ends secured to electrical elements of the generator system **28**. Lugs **86** similarly have conductor **92** soldered thereto, which lead to electrical elements forming parts of the keying circuits of the manual **24**.

When it is desired to obtain access to the underside of the generator assembly **28** the studs **64**, **65** are removed, and by grasping first the right-side plank **62**, the assembly is raised sufficiently to remove the lag screw **70** from its slot **68**, and the assembly is swung forwardly slightly to bring the lag screw to rest in a recess **94** formed in the upper edge of the angle **66**. The other side plank **63** is then similarly raised and shifted to bring its lag screw into a corresponding recess **94** in its angle **67**. Thus, when slightly elevated, the generator assembly may be slid forwardly to the position in which it is shown in dotted lines in Fig. 3, the angles **66** and **67** forming guides, while the lag screws **70** rest upon the upper edges of these angle irons.

The forward sliding movement of the generator assembly is limited by the engagement of lag screws **72** with the rearward ends of the angle irons **66**, **67**. When the generator assembly is in this position the rearward lower corners of the side planks **62** and **63** will be in alignment with the rearward edges of notches **96** formed in the main supporting frame, so that the generator assembly may have its forward end raised and swung to a vertical position. The engagement of the lower rear corners of the side planks **62** and **63** in the notches **96** prevents the generator assembly from sliding rearwardly as its forward end is being swung upwardly. The generator assembly is swung upwardly to the position in which it is shown in Fig. 4, in which position it is stable, and the underside of the generator assembly is available for inspection and servicing.

It will be noted, by reference particularly to Figs. 3 and 4, that as the generator assembly is moved from its normal position to its vertical position, the springs **88** are stretched and swung about, but nevertheless maintain the electrical connection between their respective lugs **80** and **86**, so that even when the generator assembly is in its vertical position, all of the electrical connections are maintained and the instrument is in operative condition. Thus, testing and servicing of the instrument is greatly facilitated.

To return the generator assembly **28** to its normal position, it is swung forwardly and downwardly from the position shown in Fig. 4 to the dotted line position of Fig. 3, in which position it is arrested and located by the engagement of its lag screws **70** with the upper edges of the angle iron **66** and **67**. The generator assembly may then be pushed rearwardly until the lag screws **70** drop into the recesses **94**, whereupon the lag screws **70** may be dropped into their locating notches **68**. This latter operation may be performed first at one side and then at the other.

Although the generator assembly may have an aggregate weight in excess of one hundred pounds, the mounting, as described above, makes it possible for one person to swing it quite easily to the position shown in Fig. 4, and to return it to normal position. Such movement of the generator assembly is possible without disturbing any of the electrical connections between the generator assembly and the manual assembly, because of the provision of the resilient spring connections **88** between the two assemblies.

When it is desired to remove the generator assembly from the instrument, the springs **88** may be unhooked from their lugs **80**, thus very quickly and easily severing the electrical connections between the generator assembly and the manual assembly. The operation of unhooking the springs from their lugs and rehooking them when the generator is to be replaced is very simple, and avoids the necessity of breaking and remaking soldered connections, which would otherwise be necessary. It will be understood that the springs **88** are at all times under sufficient tension to maintain good electrical contact with their supporting lugs.

In the instrument disclosed there are provided two loud speakers **96**, **97** which are mounted upon sloping panels **98**, the angle of the panels **98** being such that the acoustic beam of the loud speaker will strike the board **16**, and the latter will thus reflect a large proportion of the sound energy upwardly and outwardly into the room. If the reflecting board **16** were not provided and the instrument were placed upon a rug or carpet, the absorption of sound by the latter would be so great, especially of the higher frequency sounds, that the music would be impaired.

The backs of the speakers are in free communication with the space within the cover of the case, and an exit for the sound waves generated by the back of the speaker diaphragm is provided by the opening **41**. The generator assembly **28** does not completely fill the space within the cover, and there are numerous paths for the travel of sound through and around this assembly. This forms an excellent acoustic arrangement, since a player sitting at the manual will hear the sound produced as if it were emanating from the case itself, in the same manner that the sound from grand piano strings is in part transmitted directly from the strings and in part transmitted through the sounding board. The case itself thus provides a relatively large baffle for the speakers, and also provides an acoustic reflecting surface to assure good production of the music even though the acoustic properties of the room in which it is being played are not as favorable as might be desired.

The arrangement of the speakers in the case and the use of the acoustic reflecting panel are not claimed herein, but are claimed in my copending divisional application Serial No. 362,017, filed October 21, 1940.

While I have shown and described a particular embodiment of my invention, it will be apparent to those skilled in the art that numerous variations and modifications may be made without departing from the underlying principles of the invention. I therefore desire, by the following claims, to include within the scope of my invention, all such variations and modifications by which substantially the results of my invention may be obtained through the use of substantially the same or similar means.

I claim:

1. In an electrical musical instrument, a case, a manual having electrical elements and sup-

ported by said case, an assembly comprising some of the electrical parts of the instrument movably mounted in said case, the electrical parts of said assembly being adapted to be connected to electrical elements of said manual, the combination of an insulating terminal strip secured to said assembly, a plurality of lugs secured to said terminal strip, an insulating terminal strip secured to said case, a plurality of lugs mounted on said second terminal strip, and a plurality of coil springs respectively connecting lugs on said first terminal strip with lugs on said second terminal strip, whereby said assembly may be shifted relative to said case without disturbing the electrical connections formed by said springs between the electrical parts of said assembly and the electrical elements of said manual.

2. In an electrical musical instrument comprising a case having a frame and a cover removable from its position normally covering said frame, a relatively heavy assembly of electrical parts of the instrument normally resting in a horizontal position upon said frame but movable with respect thereto, and means for supporting said assembly in a vertical position upon said frame.

3. In an electrical musical instrument, the combination of a case having a frame and a cover removable from its position normally covering said frame, a manual having electrical parts secured to said frame, an assembly of electrical parts of said instrument normally resting in a horizontal position on said frame, means for guiding said assembly for movement to a vertical position on said frame, and a plurality of flexible extensible conductors connecting electrical parts of said assembly with electrical parts of said manual, whereby the connections between said electrical parts may be maintained when said assembly is in either vertical or horizontal position and while being moved from one position to the other.

4. In an electrical musical instrument having a case including a main supporting frame, a relatively heavy assembly of electrical parts of the instrument including a pair of side planks normally resting upon said frame but movable relative thereto, means on said frame for guiding said side planks for rectilinear movement and to limit the extent of said movement, and means on said frame cooperating with said side planks to form a fulcrum about which said assembly may be pivoted to swing it to a position exposing both sides thereof for inspection.

5. In an electrical musical instrument case, the combination of a main frame, a cover pivotally connected to said main frame at one side thereof and movable to a position uncovering said main frame, a pair of side planks normally resting on said frame in a horizontal position, a relatively heavy assembly of electrical parts of said instrument carried by said side planks, and means for guiding said side planks for sliding movement relative to said main frame, whereby said assembly may be moved to a vertical position with the ends of said side planks resting upon said frame.

6. In an electrical musical instrument, the combination of a case, a relatively heavy assembly of electrical parts of said instrument mounted within said case, said assembly being normally positioned horizontally in said case, and cooperating means on said case and on said assembly to guide said assembly for movement from its horizontal to its vertical position, whereby when moved to its vertical position both the normal top and bottom of said assembly will be readily accessible.

7. In an electrical musical instrument, a case having a displaceable cover, an assembly of electrical parts of said instrument normally supported within said case in a frame with its major over-all dimensions in a horizontal plane, means to guide said assembly for movement from said normal position to a position of rest in which the major dimensions of its frame are in a substantially vertical plane, and means maintaining electrical connections between said assembly and parts in said case throughout movement of said assembly from one of its said positions to the other.

8. In electrical apparatus having a pair of associated assemblies of electrical parts which are to be relatively moved short distances, in combination, a terminal strip attached to each of said assemblies, a plurality of terminal elements mounted upon each of said strips, and a plurality of coil springs having their ends detachably secured respectively to the terminal elements mounted on said pair of assemblies.

9. In an electrical apparatus having a pair of associated relatively movable assemblies of electrical parts requiring a plurality of electrical connections between the assemblies, a plurality of insulated electrical terminals on each of said assemblies, each of said terminals having a portion conformed to provide an anchorage for an end of a tension spring, and a plurality of tension springs each having its ends anchored to terminals on said assemblies respectively, said springs forming extensible flexible conductors between the electrical parts of said assemblies thereby making possible the movement of one assembly relative to the other without disturbing the electrical connections therebetween.

LAURENS HAMMOND.